Art. XXII.—*Further Notes on the Sipunculids of New Zealand.*

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[*Read before the Otago Institute, 8th November*, 1904.]

Plates XV. and XVI.

During the present year I have received specimens of two new species of Sipunculids, each representing a distinct genus not hitherto recorded from our coastal waters; and, in the absence of the requisite literature whereby to compare these with species described from elsewhere, I propose to give new names to them for the purpose, at any rate, of reference.

Phascolosoma,* Leuckart.

P. novæ-zealandiæ, n. sp.

A specimen was removed from the stomach of the dog-fish *Mustelus antarcticus*, which was being dissected in the Biological Laboratory.† The Sipunculid was partly macerated, but not so much as to prevent a study of its anatomy, sufficient, I believe, to characterize it.

The body-wall had been torn (by the shark's teeth, perhaps), and the skin had separated from the muscular coats, which, together with the viscera, protruded through the rupture.

Colour.—The skin is pale-yellowish; the posterior end and the introvert are pale-brown, probably darker in life.

Dimensions.—The total length of the skin is 310 mm., of which the introvert measures 75 mm.; the diameter of the body was about 10 mm.; and the base of the introvert about 4 mm. (Plate XV., fig. 1). These measurements are only approximate: in the first place the skin was softened and undoubtedly more extended than if it had been preserved in the usual manner; again, the skin was flattened so that the diameter had to be estimated.

General Description.

The skin is rough, with small brown tubercles and papillæ scattered more or less uniformly over the whole body and introvert (Plate XVI., fig. 8); but they are rather more densely arranged in the latter region, and also at the hinder end of the

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* See my article in vol. xxxvi. of the Trans. N.Z. Inst., p. 172. The worm named by Hutton *Phascolosoma annulatum* belongs to the genus *Physcosoma*, as defined by Selenka.

† At the same time and from the same viscus a species of *Echiurus* was found which differs from *E. novæ-zealandiæ*, Dendy, in having two circles of hooks at the hinder end; but its internal organs were absent, so that no means of identification were to hand.

body. Here, too, the skin is wrinkled, forming irregular circular and a few obscure longitudinal ridges.

Each papilla as seen when the skin is examined under the microscope (Plate XVI., fig. 9) is somewhat ovoid in elevation, with a narrowed base of attachment; it is circular in plan, and about $\frac{1}{10}$ mm. in diameter. It appears as a thick brown ring with a central light area. Further investigation by means of section shows that the epidermis has macerated away, and that these papillæ are entirely dermal, with a wall of connective tissue; and probably, in well-preserved material, this clear centre will not be visible (Plate XVI., fig. 10). In my sections the axial canal communicates with the subdermal spaces, and is traversed by what I take to be a nerve, which breaks up just before reaching the apex of the papilla into fine fibrils which are less stained than the nerve itself. Possibly, however, this axial thread is the remains of some secretion from gland-cells which have been destroyed (*cf.* Shipley's figure of the skin of *Onchnesoma*, pl. ix., fig. 6, Quart. Journ. Micr. Sci., xxxiii.). But it is unnecessary to discuss this matter here.

The tentacular crown was invaginated, so that the muscular wall of the introvert had to be slit open in order to ascertain the arrangement. There are numerous simple filiform tentacles springing from an undulating line of origin; and corresponding with four of these undulations are four well-marked thickenings or ridges along the œsophageal wall, of which two lie on each side, leaving a gap dorsally and ventrally. By pushing forward the wall of the œsophagus so as to cause the tentacles to occupy their proper position when fully extended, I have, as a result of the study of this preparation, been able to make a drawing of what is probably their appearance in life (Plate XV., fig. 2).

Internally, I was only able to note the following facts: The longitudinal muscles form a continuous sheet. There are two retractor muscles only, attached to the body-wall pretty far forward (my measurement gives 70 mm. below the tentacular crown: this was taken along the muscular wall, which, as above stated, was separated from the skin, hence the discrepancy between this statement and the "length of introvert").

The alimentary canal still contains mud, and its wall is pretty firm, but had been thrown into a good deal of disorder by being ejected through the rupture in the body-wall—hence I can give no satisfactory account of its coils. Notwithstanding a certain degree of digestion to which the animal had been submitted, the dorsal blood-vessel still retains an orange-brown tint, and can be traced up to the base of the tentacles and along the dorsal ridge.

Remarks.—The only species with which I have been able

to institute any detailed comparison is the antarctic form, *P. capsiforme*, Baird,* and the varieties described by Michaelsen.† From this species it differs in several important respects, and is quite distinct from it.

Sipunculus, Linnæus.

S. maoricus, n. sp.

Two individuals were forwarded to me by Mr. Suter. They were found washed up on the beach at Tauroa Point, Ahipara, near Cape Maria Van Diemen. They had apparently dried up to some extent before being preserved, as the skin is tough and hard, and the internal organs are not sufficiently well preserved to be described.

Colour.—Pale-yellowish ; perhaps somewhat translucent when alive.

Dimensions (Plate XV., fig. 3).—Total length, 116 mm., of which the introvert occupies 12 mm. ; the diameter of the body at about the middle is 10 mm., and the base of the introvert measures 4 mm.‡ The anus lies 6 mm. below the base of the introvert. Thus the length is about 11½ times the breadth, and the introvert is about one-ninth of the total length.

General Description.

The body is, as always in this genus, marked with distinct circular and longitudinal furrows, dividing the surface into a number of rectangular areas (Plate XVI., fig. 13) ; the circular furrows and ridges being more conspicuous in that part of the body which is contracted, the longitudinal ones where it is less contracted. The hinder end of the body is slightly pointed, and here the longitudinal ridges are most conspicuous, converging to the mammilla-like tip.

The introvert, which is partly retracted in both specimens, is for the greater part of its extent covered with recurved hook-like tubercles, which are white (Plate XVI., fig. 11). These are not arranged in any very definite manner, though partly they form oblique rows. The tubercles are rather larger dorsally than ventrally, and also diminish slightly in size as the tentacles are approached, at the same time becoming softer. Between the tentacular crown and the tubercles is a naked area about 2 mm. or 3 mm. in extent (Plate XVI., fig. 7). Each of the hook-shaped tubercles§ has an irregularly rounded but wrinkled apex. It is

* Fischer, "Gephyreen," Hamburg. Magalhaen. Sammelr., 1896.

† Michaelsen, "Die Gephyr. v. Sud-Georgien." Jahrb. Hamburg. Wiss. Anstalt vi., 1889.

‡ In inches this is about 4½ in length by ⅝ in diameter.

§ The word "papilla" has been used for glands immersed in the body-wall ; otherwise it would seem a more suitable word to use in the present connection.

covered by cuticle, which is thicker on the external convex surface than on the apex or inner face; below this are several "bicellular glands," which project downwards from the epidermis into the dermis or fibrillated connective tissue (Plate XVI., fig. 12). The latter is excavated by a great space which at the base of the tubercle is in free communication, by means of a small aperture, with the general body cavity. In this space is a mass of spherical cells, each with a refringent body and a deeply staining nucleus. At first I took this for a specialised group of connective tissue-cells, serving as a skeletal axis to the tubercle; but examination of serial sections shows that this mass of cells is continuous with masses of granular cœlomic cells adhering to the body-wall, and in some cases the transition between the two appearances—refringent and granular—can be made out. Unfortunately, the material is not sufficiently well preserved to enable me to describe in greater detail this structure; but it appears to serve as a means of erecting these tubercles, for when the strong muscles of the body-wall contract this cœlomic fluid will be driven into these subdermal spaces.

On the body-wall itself, as opposed to the wall of the introvert, there are no tubercles: the usual lymph-spaces alternate with groups of bicellular glands, as has been described by previous writers on the histology of *Sipunculus*.

As the tentacular crown was invaginated, it is not altogether easy to reconstruct the appearance which it has when fully extended. On slitting open the œsophagus, five ridges, covered with tentacles, are seen (Plate XV., fig. 5): of these one is dorsal, two are lateral, and two latero-ventral; the dorsal ridge is the largest, and bears more numerous tentacles. The tentacles themselves are flattened, membranous, and truncated distally—quite unlike the more or less cylindrical tentacles of *Phascolosoma* and other genera; and it has been shown by various authors that in the genus *Sipunculus* the tentacles are really the jagged edge of a membrane: various species show different degrees in which the margin of the circumoral membrane is cut into, so that in some the "tentacles" are short and in others longer. In the present species the membrane is almost entirely "frayed" out into these tentacles. By artificially pushing the œsophagus and crown upwards we may cause the crown to assume, to some degree, the condition of eversion; and from a study of such a preparation, and of the ridges themselves, I venture to "reconstruct" this tentacular crown (Plate XV., fig. 4), which is very unlike that of the species of *Sipunculus* usually figured; but from the brief diagnosis of "*Phallosoma*," Levinsen, given by Yves Delage and Herouard,* there seems to be some resemblance

* Traité de Zool. Concrète, v., p. 21.

to the tentacular arrangement of that arctic form. Again, in the same text-book, a form named *Stephanostoma* by Danielssen and Koren is stated to have "six great groups of tentacles"; but this form is regarded by Selenka as a *Phascolosoma* and not a *Sipunculus*.

The appearance, then, of this tentacular crown will be, when fully everted, very different from that of either *Dendrostoma* or *Physcosoma*.

Internal Anatomy.—The longitudinal muscular coat consists of about twenty-seven distinct bands in the middle of the body: these run independently for considerable distances—*i.e.*, anastomoses are very infrequent; necessarily they become more frequent posteriorly, where the number of bands decreases.

There are four retractors, all of the same length, arising from the body-wall about 20 mm. below the base of the introvert. The dorsal retractors arise from four longitudinal muscle-bands, and the ventrals from three of them.

The intestine, filled with sand, has such a thin wall—probably due to *post mortem* changes—that it was impossible to trace the coils, or to detect the extent of the spindle muscle, for the wall burst on the slightest touch. The coils were attached to the body-wall by numerous delicate threads. The rectum runs close to the body-wall for a distance of 8 mm., and appears to be adherent thereto.

I was unable to detect any posterior cœca, nor were the nephridia preserved.

Remarks.—I have given a new name to this *Sipunculus*, as it does not agree with the descriptions of any species in the small collection of literature available. Unfortunately I have not access to Selenka's monograph, so that it is possible that this article is a work of supererogation. Judging by the reference to the hook-like tubercles of *S. australis*, I expected that it would belong to this species; but the figure and description given by Shipley* do not seem to bear out this idea: it is true neither figure nor description is very detailed, but they are sufficient to indicate general differences. His account says nothing of the great axial cavity of the tubercle, and his figure shows gland and tubercle as distinct things (pl. xviii., fig. 5); and the brief diagnosis given by Quatrefages† does not incline one to refer my specimen to that species. The same negative result follows a comparison of the diagnoses of other Australian species given by the latter author.

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* Willey's Zool. Results: Report on *Sipunculoidea*.

† Hist. Nat. des Annelés, ii., p. 619.

Note on Dendrostoma.

D. huttoni, n. sp.

In my previous article (Trans. N.Z. Inst., xxxvi., p. 180) I spent some time in trying to demonstrate the probability that *Sipunculus lutulentus*, Hutton, is a synonym of *S. æneus*, Baird, and proceeded to state that I believed the species of *Dendrostoma* that I was describing was identical with the latter. I am now of opinion that I was altogether too precipitate in my conclusions. Some of the reasons that led me, at that time, to formulate these conclusions were: (1.) Two genera of Sipunculids, and only two, had been collected in recent times on our shores, and these at various spots from Auckland Harbour to Stewart Island. (2.) Both these had been described, so far as external features are concerned, and had been named, by Captain Hutton. (3.) In this Museum were certain tubes containing examples of two forms, with Hutton's labels upon them: one of them is undoubtedly the type of *Physcosoma annulatum*; the other I had reasons to think might be the type of his *Sipunculus lutulentus*. (4.) The latter, however, I found to belong to the genus *Dendrostoma*.

The proper proceeding would have been to have named this species *Dendrostoma lutulenta*, Hutton; but I went further, and, concluding that Hutton's species was identical with Baird's, gave it the name of *D. æneum*.

Now, there are two very important lacunæ in the evidence for this procedure: Firstly, we have no knowledge whatever, from the brief account of the external anatomy given by Baird, of the generic status of "*S. æneus*." Secondly, we are by no means certain that the specimen alluded to as coming from Cape Campbell is Hutton's type of "*S. lutulentus*"; for, although Captain Hutton wrote me that, so far as he remembered, he had only one specimen of this species and that came from Cape Campbell, yet the individual is *less than half the size* of *S. lutulentus* as described by him. That ought to have put me on my guard against identifying the *Dendrostoma* with Hutton's species.

Now, in his original account of *P. annulatum* Hutton states that he had obtained specimens from Dunedin and Cape Campbell: the former is in the Museum, as I stated in my article, fully labelled by Hutton; but I cannot find any specimen of this species with the latter locality attached. It has occurred to me that possibly this specimen referred to as "*b*" in my article was mistaken by Hutton for an individual of *P. annulatum*: it is true it differs in various ways from that species, even externally, but in size and general form it is more like it than like his description of *S. lutulentus*. At any rate, I ought to have

been contented with the suggestion merely of the identity of the *Dendrostoma* with Hutton's *S. lutulentus*. But since writing that article I have received representatives of two more genera, and this leads me to doubt whether even this suggestion is probable. We must bear in mind that at the time Captain Hutton wrote the limitations of the genera of Sipunculids were by no means so clearly recognised as at the present day; and it is not quite certain to what genus Hutton's species belongs.

I propose, then, to name the *Dendrostoma* after our leading naturalist in New Zealand, so that it will now stand as *Dendrostoma huttoni*, Benham = *Phascolosoma huttoni*, Benham (Index F.N.Z.) = *Dendrostoma æneum*, Baird (Benham, Trans. N.Z. Inst., xxxvi., p. 177).

Both Baird's and Hutton's species of *Sipunculus* must stand amongst our "species inquirendæ." I much regret the confusion to which my former article will perhaps give rise.

The figure (pl. vii., fig. 12) illustrating my account* of the tentacular crown of *Dendrostoma huttoni* does not do justice to the elegance of this organ: the lobes are too broad and the tentacles too short. I have therefore drawn another figure from a fully extended specimen, which is reproduced on Plate XV., fig. 6, for comparison with the corresponding organ of the genera described in the present communication.

EXPLANATION OF PLATES XV. and XVI.

Fig. 1. *Phascolosoma novæ-zealandiæ:* half natural size.
Fig. 2. The tentacular crown of the same: oral view; magnified; reconstructed.
Fig. 3. *Sipunculus maoricus:* natural size. *a*, the partially retracted introvert; *b*, contracted region of the body, where the circular ridges are very distinct.
Fig. 4. Tentacular crown of the same: oral view; magnified; reconstructed.
Fig. 5. One of the latero-dorsal ridges of the tentacular crown of the same, as seen on the wall of the opened introvert: stained and mounted; the arrow indicates the anterior end of the body; (camera, magnified).
Fig. 6. *Dendrostoma huttoni:* oral view of tentacular crown; magnified.
Fig. 7. *Sipunculus maoricus:* side view of the anterior end of the introvert; magnified. *a*, tuberculated region; *b*, smooth region.
Fig. 8. *Phascolosoma novæ-zealandiæ:* a piece of skin from the body-wall, as seen through a hand-lens, showing the characteristic papillæ (*p*).
Fig. 9. The same: a papilla much enlarged.
Fig. 10. The same: a papilla in longitudinal section (camera × 80). *ax*, axial canal; *ct*, dermis; *pg*, pigment granules of the outer part of the dermis (the epidermis had macerated off); *x*, cord of granular material in the axial canal (? nerve or secretion).

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* Trans. N.Z. Inst., xxxvi., p. 177.

Fig. 11. *Sipunculus maoricus:* piece of the wall of the introvert (seen under a low power), showing the hook-shaped tubercles; with (*a*) an axial mass of cells.

Fig. 12. The same: a tubercle in longitudinal section (× 80). *a*, axial mass of cells, in continuity with—*c*, a group of cœlomic corpuscles; *cm*, circular muscles of body-wall; *d*, dermis; *gl*, epidermal glands; *lm*, longitudinal muscles.

Fig. 13. The same: a portion of surface of body (as seen through a hand-lens) showing the characteristic longitudinal and circular grooves marking out raised rectangular areas.

Art. XXIII.—*The Aquatic Larva of the Fly* Ephydra.

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Plate XVII.

Amongst the organisms collected by Mr. J. A. Thomson in a saline pool at Barewood, Central Otago, which were submitted to me for identification by Mr. G. M. Thomson, were a number of small brown larvæ, or rather "puparia," having rather a peculiar form. This larva, which for reasons stated below I ascribe to the Dipteron genus *Ephydra*, resembles in general form and structure the "rat-tailed" larva of the hover-flies (*Helophilus** and *Eristalis*†)—in the very reduced condition of the head, in possessing a series of paired groups of claw-shaped spines segmentally arranged along the ventral surface, and in the long posterior respiratory tube or "tail"; but in the two genera just named this tube is retractile, whereas in the insect herein described it is not retractile, and is, moreover, bifurcated.

In looking through the small amount of general literature on the *Diptera* available here, the only genus of flies that I was able to find in which the larva of this general form of structure has a bifurcated respiratory tube is *Ephydra*. No doubt a figure of this larva is to be found in one or more recent monographs, or in memoirs published in periodicals concerned with entomology; nevertheless, in the interests of those who are unable to consult these works, it seems to me worth while to present a brief illustrated account, so that naturalists in New Zealand may be able to identify the creature. My identification rests upon the brief accounts contained in Westwood's "Introduction to the Modern Classification of Insects" (1840), and in Packard's "Guide to the Study of Insects" (1872). The former author

* Hudson, N.Z. Entomology, p. 58, pl. vii., fig. 1.

† Miall's Nat. Hist. Aquatic Insects, p. 198 *et seq.*